NBSIR 73-278 (4 Volumes)

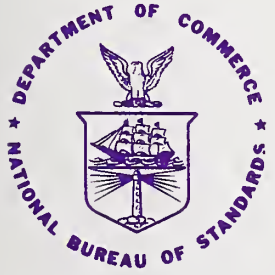
Model Documents for the Evaluation, Approval, and Inspection of Manufactured Buildings

VOLUME II – SUBMISSION DOCUMENTS

CES Project
Office of Building Standards and Codes Services
Center for Building Technology, IAT
National Bureau of Standards
Washington, D. C. 20234

September 1973

Preliminary Report



U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NBSIR 73-278 (4 Volumes)

MODEL DOCUMENTS FOR THE EVALUATION, APPROVAL, AND INSPECTION OF MANUFACTURED BUILDINGS

VOLUME II – SUBMISSION DOCUMENTS

R. D. Dikkers, H. R. Trechsel, P. W. Cooke, H. K. Tejuja, L. P. Zelenka

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September 1973

Preliminary Report

This is a preliminary report issued with the express intent to solicit comments and suggestions. Accordingly, results and conclusions contained herein are not necessarily those that will be included in the final report.

U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

PREFACE

In response to requests from the Executive Office of the President and the National Conference of States on Building Codes and Standards (NCSBCS), the National Bureau of Standards has undertaken specific research programs to remove or reduce barriers created by the building regulatory process, so as to improve productivity and innovation in building construction. One of these programs is to establish a Coordinated Evaluation System (CES) by developing, in conjunction with the state governments, model informational documentation for use in the building regulatory process.

This four-volume report outlines the results of an initial study of documentation needs, sample forms and checklists pertaining to manufactured buildings and components. It is a preliminary report issued with the expressed intent to solicit comments and suggestions so that more comprehensive and more generally applicable model documentation can be developed.

A first draft of this report was reviewed during a 2 1/2 day meeting in April, 1973, by a group of consultants composed of representatives of state and local building officials, design professionals, third party evaluation and inspection agencies, and industrialized building manufacturers. The review meeting was organized and chaired by Mr. John Dunlap, Consulting Engineer of Sacramento, California. The other consultants were:

Joseph Bartell, City of St. Petersburg
Jack Bono, Underwriters Laboratories, Inc.
Kern E. Church, State of North Carolina
Jasper Hawkins, Hawkins and Lindsey, Architects
James M. Hicks, State of California
Glendon R. Mayo, Consulting Engineer
J. Dillard Powell, Continental Homes
Ed Starostovic, Product Fabrication Service
Joseph Stein, City of New York
Steve Wilson, National Homes Corporation

The comments of the consultants were most helpful in developing the model documents contained in this report, and their valuable assistance is greatly appreciated and herewith acknowledged.

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MODEL DOCUMENTS FOR THE EVALUATION, APPROVAL, AND INSPECTION OF MANUFACTURED BUILDINGS

R. D. Dikkers, H. R. Trechsel, P. W. Cooke,
H. K. Tejuja, L. P. Zelenka

To assist the states in developing their building regulatory activities and functions, the Coordinated Evaluation System (CES) Project has defined and developed model informational documentation pertaining to the functional areas of data submission, evaluation, approval, compliance assurance, installation data, and owner information.

This is a preliminary report which gives the results of the investigation to date, and presents discussions of informational needs and sample model documents pertaining to manufactured buildings and building components. The model documentation is based on the Model Rules and Regulations for manufactured buildings developed by a Department of Commerce sponsored working task group, and the results of a comprehensive state-of-the-art study of most of the existing state building regulatory programs. The documentation presented in this report covers all functional areas except owner information which is not usually subject to regulation and will be covered by a separate report. Emphasis was placed on developing documentation applicable primarily to one and two family detached dwellings.

Based on the comments received on this preliminary report, the documentation presented herein will be revised and a final report issued.

Key words: Building codes; certification; compliance assurance; evaluation; industrialized building; inspection; model documents; NCSBCS; standards; state regulation.

APPLICATION FOR BUILDING SYSTEM AND COMPLIANCE ASSURANCE PROGRAM APPROVAL

The application form, CES Document No. S-01, was developed to serve three purposes: As a transmittal of the required documents; as a request for evaluation; and as a format to transmit some information not normally included in the building systems and compliance assurance documentation. It is not the purpose of this document to serve as a legal contract between a third-party Evaluation Agency and a manufacturer. Such a legal contract, where required, would need to be developed and signed in addition to the "Application Form".

The form also includes some information regarding the system or program which will aid the Evaluation Agency in quickly determining the character of the system or program so that the review and evaluation can proceed more rapidly. The usefulness of such additional information in the application form depends on the Administrative and/or Evaluation Agency's organization. Given below and on the following pages are a list of form contents, instructions on how to fill out the form, and a suggested application form.

Suggested Content of Application Form

1. Name of manufacturer and business or corporate address.
2. Address of fabrication plant or plants.
3. If application is for approval of a building system, name and address of signing registered architect or professional engineer if required by state law.
4. If application is for approval of a compliance assurance program, name and address of inspection agency.
5. Type of application (building system, compliance assurance program, or both).
6. If application is made for a compliance assurance program, an indication of whether such program is based on a previously approved building system, and application and approval number of such system.
7. Building classification (occupancy, use, type of construction) for which approval is sought.
8. Type of system (building module, mechanical core unit, wall panel, etc.).
9. Basic materials used and construction method (wood frame, steel, concrete, masonry).
10. Design parameters (live, wind, snow, and seismic loads, design temperatures).
11. Listing or index of documents submitted with application (plans, specifications, calculations, test reports, shop drawings, samples, compliance assurance manual).
12. Indication of other states in which the submitted system or program may have been approved, including date, application number and approval number. If approval of the application is sought on the basis of reciprocity, it should be so stated and the building systems approval record should be included in the submission.

13. Space for recording fee deposit.
14. Signatures of applying manufacturer or his agent.
15. Space for approval signatures(s) and/or stamp(s) with date of approval.
16. Space for application and approval numbers.

Instructions for Completion of Application Form

Section I. This section should reflect the type of approval sought. This application should be used when seeking approval for a new building system or a C.A. program or a major modification to a previously submitted building system or a C.A. program. Modifications of a floor plan or of a construction system, including electrical, mechanical or plumbing systems constitute a major modification. A dimensional change which does not change the system or configuration and which could be incorporated in the originally submitted plans by the Administrative Agency is one example of a minor modification. Use CES Document No. S-10 when applying for a minor modification. If application is submitted for a major modification to a building system or a C.A. program, before the previously submitted system is approved, the application number of the system should be indicated. If application for a major modification is submitted for major modification to a system which is partially approved (e.g. has a building system approval, but the C.A. program is still under process of approval or vice-versa), then both the application numbers and approval numbers (if any), should be so indicated.

Section II. If application is submitted for a C.A. program approval, the name of Inspection Agency monitoring the C.A. program should be indicated. The space (Name of Reg. Architect/Prof. Engineer _____) is to be filled out in cases where the services of a Reg. Architect and/or Prof. Engineer have been utilized. Where additional space is needed for the required listing of architects and engineers, this additional information should be indicated on the reverse side of the application form. Where manufacturing operations are conducted in more than one location, indicate such locations on the reverse side of the form.

Section III. Calculations submitted should be identified, e.g. heat loss, structural, electrical, etc. Approval numbers of the same system approved by other states should be indicated and if approval reports from other states are included with the submission, they should be so identified in the space ☐ other (specify)_____.

Section V. In first line, applicant should indicate to what codes and standards the building system conforms.

STATE OF _____

[Name and Address of Administrative Agency]

APPLICATION FOR BUILDING SYSTEM AND COMPLIANCE ASSURANCE PROGRAM APPROVAL

NOTE: Applicants should complete all items (I-V). Mark boxes where applicable.

I. TYPE OF APPLICATION

☐ New System or Program ☐ Major Modification
☐ Building System and C.A. Program
☐ Building System (only)
☐ Compliance Assurance Program (only)
☐ Previous Application or Approval Numbers:
Building System_____ C.A. Program_____

VIII. AGENCY USE ONLY

Building System Appl. No._____
C.A. Program Appl. No. _____
Date of Application _____
Fee Deposit Received _____

II. IDENTIFICATION

Name of Manufacturer_____ Tel. No._____
Address _____
Location of Manufacturing Plant_____
Name of Inspection Agency_____
Address _____
Name of Reg. Architect/Prof. Engineer_____ Reg.No._____
Address _____ State _____

III. DOCUMENTS SUBMITTED ☐ Plans ☐ Specs ☐ Test Data ☐ Shop Dwgs. ☐ C.A.Manual ☐ Sample
☐ Calculations (Type)_____ ☐ Other (Specify)_____
☐ Other State or Agency Approvals/Listings_____

IV. DESCRIPTION OF MANUFACTURED BUILDING OR COMPONENT

A. Occupancy: ☐ One and Two Family Detached ☐ Other (Specify)_____
B. Type of Construction (Classification)_____
C. Type of Systems: ☐ Unitized Modular ☐ Core Unit ☐ Component
☐ Architectural ☐ Structural ☐ Mechanical ☐ Plumbing ☐ Electrical
☐ Other (Specify)_____
D. Principal Construction Material: ☐ Wood ☐ Concrete ☐ Steel ☐ Masonry
☐ Other (Specify)_____
E. Energy Source: Heating_____ Cooling_____
F. Design Parameters: Live Load___ Wind Load___ Snow Load___ Seismic Load_____
G. Design Temperatures: Summer_____ Winter_____

V. SIGNATURES

This is to certify that the building system conforms with_____
Signature of Reg. Architect/Prof. Engineer (if reqd)_____ Date_____
Signature of Applicant/Agent_____ Date_____
Name and Title of Applicant/Agent_____ Tel. No._____
Address _____

VI. AGENCY USE ONLY ☐ Bldg. System Approved ☐ C.A. Program Approved
Signature of Agency Official_____ Date _____
Name and Title _____

GENERAL SUBMISSION REQUIREMENTS

This CES Document discusses general items which apply to all submission requirements (architectural, structural, electrical, mechanical, and plumbing), based on Part V, Section 1(A) of the Rules and Regulations.

Specifications

A separate set of specifications may be required in applications for approval of complex or innovative building systems. For simple, conventional one and two family dwellings, it is usual to show all pertinent information on the drawings or on tables which have the same format as the drawings. Some Evaluation Agencies do appear to favor the use of extensive specifications, while others prefer that all information be given on the drawings. The CES submission documents are based on the premise that specifications are not a necessary submission requirement.

Drawings

All drawings should be submitted in a single format and should be bound in sets. The scale of the drawings should be marked on each drawing and should also be shown graphically. It is preferable that each sheet contain only drawings at a single scale. If this is impractical, the scale (both numerical and graphic) must be given for each part. The scale of the drawings and the size and style of the lettering should be such that they can be easily read. As a rule, plans and sections should be drawn to a scale not smaller than 1/8 inch to a foot, and details should be shown at a scale consistent with the complexity of the detail.

Specifically, Part V, Section 1(A) requires the following items to be placed on the submission drawings (numbers given below correspond to those given in the Rules and Regulations):

(3) Identification of manufacturer and plant.

(5) Signature of registered architect or professional engineer if required by state law.

(6) Clear distinction between that work which is to be performed in a manufacturing plant, and that work which is to be performed on-site.

(7) A 3-inch by 4-inch blank space for approval stamp.

(12) Date and sheet number, and number of sheets in set.

In addition, the building system should be clearly identified on each sheet, and a space for marking the nature and date of any revisions should be provided.

References To Standards

Where information necessary for the proper construction or installation of an element is contained in a standard and not repeated in the documents, such standard should be clearly noted and identified in all applicable places (drawings, specifications, calculations, etc.). Such identification should make reference to the specific portion of the applicable standard, and if the standard is not contained in standard reference publications, a copy of the standard should be included in the submission documents. The same recommendation applies to test methods and test reports which are discussed in greater detail in CES Document No. E-09.

Alternate Designs

According to the definition of "building system" as given in Part I(F), alternate designs of a manufactured building or component may be submitted as a single building system. Such alternates should be of the same construction method and for the same intended uses. Examples of alternates would be a manufactured building for which approval is sought both with a gable end roof and with a hip roof, or a model which has an alternate interior room arrangement, or is to be built in differing sizes.

Where such alternates are submitted as part of a building system, they should be clearly identified on all documents and all information regarding the alternate construction must be given to permit their evaluation for code compliance in the same manner as required for the basic system. In particular it is not sufficient to indicate on the documents only the alternate construction itself, but also the influence such alternate has on the basic system. For example, where an alternate addition of a room blocks a required exit way, it is mandatory that the documents show an alternate exit.

It is also permissible to show a range of alternates in the building systems submittal. For example, a range of widths may be given for a patio door which may vary between 2'-8" and 6'-0". In these cases header and jamb post schedules, together with all necessary calculations, may serve to show how the structural requirements for the various widths are met.

When submitting alternates it is particularly important that such alternates also be recognized in, and coordinated with, the compliance assurance manual. Specifically, the inspection checklists must include the necessary notations to alert the inspector to the fact that alternates are to be inspected.

Handling, Transportation, and Site Related Items

In order to properly evaluate a building system and to define the respective jurisdictions of the state regulatory function and the local enforcement function, it is necessary to clearly indicate on all documents: (1) those code related items which are constructed in-plant (manufactured); (2) those items which are constructed on-site; (3) the method of joining and connecting the manufactured unit to the site built parts; and (4) to give such information on transportation, handling, and erection which may be required to assure that concealed parts of manufactured and certified units can not be damaged before completion of erection. The items associated with handling, transportation, installation, and on-site work that may need to be included in the building system submission are:

(1) Method of protection against the elements during transportation and storage;

(2) Lifting points and any temporary bracing required for the unit or for individual parts and equipment;

(3) Tie-downs and supports needed during transportation, and total weight of each certified unit;

(4) Details of field connections between adjacent units, including flashing of field joints, etc.;

(5) Details of connection of the unit to its site built foundation, including a diagram showing location of such connections; sizes of required site-installed anchors and bolts and the tolerance requirements for their location; method of adjustment for levelling; utility connections, etc.; and

(6) Indication of any accesses which need to be incorporated in foundation walls so that the units can be properly installed and connected to utility services.

ARCHITECTURAL SUBMISSION

Part V, Section 1(B)(1) to (3) gives the submission requirements in regard to general construction details, building classification, space and fire safety. This document discusses each of these requirements and provides additional details as an aid to the manufacturer in the preparation of the building system submission.

The documentation depicting the architectural, fire safety, and health and safety items should provide the information necessary for the evaluator to determine that these items conform to the requirements of the applicable codes. This documentation in general should consist of at least all floor plans, sections, and elevations. In addition, these documents should also be suitable to serve the inspector in determining that the unit under construction or constructed is in fact built according to the documents.

1. General

(a) Installation Details. This item is discussed in CES Document No. S-02.

(b) Exterior Elevations. All exterior elevations of the unit should be shown. Such elevations should show the location of all openings, such as door, windows, ventilators, etc., and should show the roof line or lines, roof draining system, eaves, chimneys, steps, balconies, porches, lighting fixtures or their location, integral plant boxes and similar ornamental attachments, and the location of the certification label. In addition, floor and ceiling lines should be marked, and materials properly identified. Schedules, tables, or part elevations may be used to show alternate designs or ranges of alternate designs.

(c) Cross Sections. All necessary cross sections should be given to show floor and ceiling levels, platforms, stairs, wall openings, chimneys, ventilators, roof slopes and eaves, over-hangs and cantilevers, fixed awnings, porches, and the like. All heights should be properly dimensioned, materials given by grade, type, etc., and, if a site-built foundation is shown on the section, the dividing line between it and the factory-built unit must be clearly defined. The cross sections also should show the levels for the site-built foundations or supports if the foundations are not shown. Where a manufactured building is assembled on-site from manufactured components, the single components should be clearly identified and defined on the sections.

(d) Flashing Details. The method, size, material, and location of all flashings must be shown and identified. Of particular interest are flashings or provisions for them built into the unit, but used to cover joints on the building site, such as

joints between adjacent modular units, between manufactured components, and between manufactured parts and site-built elements. In these cases, the details must clearly indicate by notes or otherwise what work is to be done in the plant, and what work is to be done on-site, including an indication of whether the necessary material for on-site work is provided by the manufacturer or by the installer or builder.

(e) Attic Access and Ventilation. Location, size, and type of access to the attic should be shown, including details of trap doors, ladders, etc., needed for gaining access to the attic space, as well as any flooring or "cat-walks" within the attic space. Also included should be the necessary information regarding mechanical devices used in the attic access, such as counterweights and balances, and the clearances provided around and above the access area and the stairs or ladder leading to it.

Attic ventilators should be shown and identified as to type and, in case of mechanical or electrical devices, should be included in the appropriate wiring diagrams. The air flow direction should be indicated and the capacity given.

(f) and (g) Finish Materials. All exterior and interior materials and their finishes should be shown. Such information should include not only the basic material, but also the grade and any other information to positively identify such materials, including references to appropriate national standards if available, as well as pattern, type of application ("vertical siding" or "shingles"), and finish (painted, stained, etc.). If louvers or perforated panels are a part of the exterior walls or the soffit, such parts should be shown and their type, material, and finish identified.

(h) Doors and Windows. Exterior doors, windows, and other openings should be shown on the elevations keyed to appropriate schedules giving dimensions and other pertinent data, and should be dimensioned on the plans and in the sections. Separate schedules are often used for windows and doors with key letters or numbers on plans, elevations, and sections to locate the particular items.

For application in high-wind areas, the wind resistance of the windows should be given and references made to test results, certification, or standards of the window and sliding door type and size used. In addition, for sliding or patio doors, the glass should be identified to thickness and type (plate, safety, tempered, etc.) and reference be made to test results, certification, or standards of such glass.

(i) Foundations. Recommended or suggested foundation plans should be shown, giving the location and level of all connectors and anchors by which the manufactured building or component is attached, and showing the bearing loads acting on the foundation. For additional information, see CES Document No. S-04 on structural submission requirements.

In addition, the recommended foundation plans also should show access, vents, and other items that are required in the foundation to properly install, connect, and maintain the manufactured unit. See CES Document No. S-02 for an additional discussion on this item.

2. Building Classification

(a) Occupancy - Use. Occupancy and use of the manufactured building, or of the building in which a manufactured component is to be installed, is to be given on the application form (see CES Document No. S-01). However, this information should be repeated on the drawings.

In addition to the occupancy and use classification of the unit, each room within a manufactured building should be identified (such as living room, kitchen, etc.).

(b) Area, Height, Number of Stories. The plans should contain the total building area. Heights and number of stories should be shown on the cross sections discussed above.

(c) Type of Construction. The basic type of construction classification for the manufactured building is to be given in the application form (CES Document No. S-01). If the actual construction of various parts or elements of the building are of different materials and construction methods, each such method should be properly identified so as to permit the evaluation and classification of the building.

(d) Fire Resistance Ratings. Where required the fire resistance ratings should be given for all rated stairway enclosures, doors, walls, floor, and roof assemblies, partitions, columns, and shaft enclosures. Where such ratings are tied to specific or proprietary materials and/or systems, such materials or systems must be identified on the drawings and other documents. The ratings should make reference to tests performed, certification or labeling, etc.

3. Space and Fire Safety

(a) Fire Resistance Rated Assemblies. All fire resistance rated assemblies should be adequately detailed. Openings in walls, floors, ceilings, partitions and other building elements must be dimensioned and provision for such items as fire dampers must be identified, including any rating of such equipment. The exact location and extent of any required fire rated wall or partition should be clearly shown. For example, it must be indicated whether a fire separation wall extends above a ceiling to the underside of the floor above, whether it stops at the finished ceiling height, or whether it bypasses the floor or roof above.

(b) Exit, Stair, and Passage Enclosures. The width of all aisles, exits, corridors, passageways, and stair enclosures should be shown. The method of dimensioning should clearly show whether such dimension refers to rough or clear dimensions, and whether the dimension is taken between walls or between handrails. On stair platforms, the dimension between the stair railing or newel post and the back wall of the landing or platform should also be shown.

(c) Toxicity and Flamespread Classification. According to the Model Rules and Regulations, the toxicity and flamespread classifications should be shown for all finish materials. For all such ratings, reference should be made to the appropriate test reports, certifications or labelings. The exact extent of all flammable finish surfaces should be noted on the drawings, and any interruptions of such surfaces should be shown.

In regard to fire safety, reference should also be made to CES Documents No. S-05 and S-07 which discuss mechanical and electrical submission requirements.

STRUCTURAL SUBMISSION

Part V, Section 1(B)(4), (a) through (l), of the Rules and Regulations gives the submission requirements for structural items in general as well as in specific terms. This document discusses each of these requirements in detail as an aid to the manufacturer in the preparation of the structural submission documentation. The requirements as given below are based on a typical, conventional submission. It is recognized that with the increased use of computers and computer based design and drafting methods, alternate submissions based on such new methods should also be acceptable to the evaluator.

General Requirements

The documentation depicting the structural system for manufactured buildings should provide the information necessary for the evaluator to determine that the structural design of the proposed units complies with the regulations. For small structures, all pertinent information is often included on the structural drawings rather than in separate specifications.

The structural drawings or separate specifications should contain a section of general notes. These notes should include a listing of all of the standards followed in designing the structure and those applicable to its fabrication, the design loadings and the grade or quality of material to be utilized in constructing the structural system.

It is permissible to use a format for structural calculations and drawings that permits flexibility in construction, such as showing variations in the spans of members, the locations of walls and openings, etc., provided that the drawings specifically define the element to be varied and clearly identify the limits of its variation. As a general rule, the drawings should depict the system at its maximum, and identify elements that can be omitted or reduced. Examples of this include the depiction of a wall with the maximum number and size of openings that would occur in the units produced, and noting those that may be omitted, reduced or moved within the maximum and minimum dimensions shown; the depiction of a floor plan with maximum and minimum dimensions for the width and length of the structure and the location and length of bearing and shear walls; and the scheduling of the type and size of joists or rafters to be used for various spans. In the drawings, the information must be presented in a manner that can be readily interpreted by the evaluators and inspectors. The calculations must substantiate the adequacy of units incorporating the combinations of variations that produce the least capacity to support the design loads.

The structural drawings should clearly and specifically identify the elements that are to be constructed in the plant and those that are constructed or installed at the installation site. It is preferable that all work to be performed at the site

to be depicted on a sheet of the drawings separate from those showing the construction to be performed in the factory.

(a) Engineer's Calculations of Structural Members, Where Appropriate. Calculations should be provided for all members and connections supporting other than nominal loads. The only exceptions to this requirement are structural members utilized in accordance with specifications contained in the regulations or otherwise approved by the Administrative Agency (or Evaluation Agency). Examples of these exceptions are the use of wood rafters or joists as specified by the model building codes, and the use of open web steel joists selected from load and span tables prepared by an industry association and approved by the Administrative Agency.

The calculations should be organized in a comprehensive manner and be clearly identified with the element of the structural system they pertain to, so the evaluator may easily review the design processes. The calculations should list the design loads, including the controlling combinations of loads, the standards which were followed in preparing the design, and the material, grade and size of members and connectors selected to satisfy the design requirements. Unless otherwise approved by the Administrative Agency, the standards for the design and for the materials selected should be those contained in or referenced by Part III, Section 1 of the Rules and Regulations. The use of materials or construction methods for which approved standards do not exist may be permitted when their adequacy has been substantiated to the satisfaction of the Administrative Agency.

The calculations should also substantiate the capability of the structure to withstand lifting stresses, and unless specific exemption is granted, design loads due to wind or seismic forces. Both the calculations and the drawings should identify the points of lifting and support during transportation. The calculations should provide a complete analysis of how these loads are resisted by the structure, including points of concentrated loads and the anchorage of lifting inserts if any. If lifting slings are used, the analysis should include the effects of the vertical concentrations at the floor and the horizontal reactions of the slings at the floor and eave lines. Appropriate impact factors should be applied to lifting loads. The analysis substantiating the adequacy of the structure to withstand design loads due to wind or earthquake should include calculations for both individual elements and the structure as a whole. A complete analysis should also be made of the connections.

Where the analysis of the structure is performed through the use of a computer, a copy of the applicable programmer's manual should be submitted with the computer print-out unless specific exemption is granted. In this case, sketches of the structural framing with the members numbered as entered in the program should be included.

(b) Design Soil Bearing Value. In many instances, the foundation may not be included in the building system submission. In these cases, the manufacturer or builder should obtain approval of the foundation from the local jurisdiction as provided by Part IV, Section 5 of the Rules and Regulations.

However, if a manufacturer submits one or more foundation designs, each such design should identify the required minimum soil bearing capacity. When this is done, the drawings should clearly note that the foundation for a specific site should be approved by the regulatory agency with the appropriate jurisdiction, prior to its installation. The substantiation of the adequacy of foundation systems should include the effects of expansive soils when encountered, considerations of depth of footings to avoid frost-heaving, as well as proper bearing capacity.

Regardless of whether or not the foundation is part of the structural submittal, the structural drawings should show the location and magnitude of all loads to be supported by the foundations. Particular attention should be given to concentrated loads such as those resulting from the reaction of beams supporting relatively large loads that may be supported on isolated footing pads. With the exception of small structures (generally one story), the loadings should be broken down into dead, live and lateral loads to provide the information necessary to consider the results of soil settlements.

(c) Structural and Framing Details of all Floors, Roof and Walls. The structural drawings should include a framing plan for each floor and the roof. Repetitive framing plans for the floors of structures with more than one story may be combined on one drawing, provided that variations are minor and are clearly identified.

Framing plans should identify the material, size, location and orientation of all structural members, bracing and bridging, and the structural materials acting as the surfaces of the floors and roof. The connections of the walls and floor to the foundations should be detailed. Structural framing around all openings, including those for mechanical ducts, should be shown, as well as that supporting mechanical equipment.

Where the use of alternate or optional framing or surfacing materials is proposed, these options must be clearly identified on the drawings.

(d) Details and Stress Diagrams of Roof Trusses. Trusses should be thoroughly detailed on the structural drawings, including the dimensions for length and rise of the truss; and the size, material and orientation of each member. The connections at each joint should be clearly shown and the connecting device or method specifically

identified. Connectors should be located by dimensions from the sides and ends of the members connected. Structural adhesives used in connections should be specifically identified and the standard applicable to their use referenced on the structural drawings.

The analysis of trusses should take full account of their method of support. For example, it is not acceptable to submit an analysis of a truss supported at its ends, when in the actual structure it also bears on interior walls. Line stress diagrams are acceptable. Where the loads occurring between panel points induce bending significantly affecting the member stresses, such effects should be included.

(e) Detail of Reinforcing Steel. The structural drawings for concrete elements should clearly show the size, number, spacing and location of the steel reinforcing bars. In addition, the drawings should conspicuously note the grade of reinforcing steel to be used and the maximum spacing of bar supports. The structural detailing should include the clearance of the reinforcing from the concrete surfaces, and the lengths, laps and any bending for each bar. The specific requirements for radii of bends should be noted.

The tabulation of reinforcing in schedules is acceptable, providing the format used provides for ready interpretation of the information by inspection personnel not necessarily skilled at inspecting concrete construction.

All items to be embedded in concrete structural elements should also be clearly detailed, including minimum concrete coverage and embedment of anchorage and, in cases of possible obstructions, relationships to the steel reinforcing. The structural drawings should show mechanical and electrical elements to be cast in the concrete, including conduits.

(f) Complete Loading Schedule. The structural drawings should contain a listing of all of the maximum loadings the structure has been designed to withstand. This listing will include the floor and roof live loads, wind, seismic, and the dynamic factors applicable to the lifting of the unit.

(g) Column Loads and Column Schedule. With the general exception of one and two-story buildings, the drawings for all structures should contain a tabulation, in schedule form, of the material, size, orientation, length and location of columns or studs used in the structure. Also included on this schedule or readily keyed to it should be a tabulation of the vertical design loads. The live loads and dead loads should be indicated separately.

(h) Lintel Schedule. The structural drawings should contain a tabulation of the material, size and orientation of the members supporting the loads over the openings in all walls and partitions of the structure. Where members of different sizes are

used over openings of the same width because of a variance in the loads supported, the limitations applicable to their use should be clearly identified. For example, it is not sufficient to differentiate between headers used in bearing walls and those used in non-bearing partitions, unless the drawings specifically identify those walls which are bearing walls.

(i) Size, Spacing and Details of All Structural Elements. All of the information necessary to construct and inspect every element that serves to support the loads the structure has been designed to withstand must be included on the structural drawings. Major members should be shown on framing plans and wall sections. Smaller elements, such as anchorages or connections should be shown on appropriate detail drawings keyed to the framing plans and sections. References to locations or spacings of items with critical tolerances should be specific, such as in the case of anchor bolts for columns or tiedowns for shear walls.

All penetrations of structural members by electrical, plumbing and mechanical components must be fully detailed or described, including the size and location of holes. Such dimensions may be expressed as maxima and minima.

(j) Grade or Quality of All Structural Elements. Where the adequacy of a structural element is dependent on its being of a particular grade or quality, such information should be included in the building system. As a general guide, all the data necessary to duplicate the design of the structure if the original computations were not available, should be included. Examples of this data are the required grades of lumber, plywood, bolts, structural steel, reinforcing steel, and the design strengths should be based on a code or standard referenced by Part III, Section 1 of the Rules and Regulations.

Where the structural system includes an element or material for which a standard has not been previously approved, the information on the drawings should include the properties necessary to determine its adequacy for the use proposed, i.e. ultimate bending and shear strength, yield strength if applicable, factors of safety, modulus of elasticity, shear modulus, etc.

(k) Elevation of Structural Elements, Walls or Sections Thereof Providing Resistance to Vertical Loads or Lateral Forces. The drawings should depict the structural system in such manner that it will be constructed in accordance with the approved design. In most instances it is not possible to accomplish this by relying on the architectural drawings and the structural roof and floor framing plans alone. As a minimum requirement for showing wall construction, a section through each exterior wall and each bearing wall should be shown on the drawings. It may be necessary to show more than one section through walls supported at the level of ceilings that vary in height. Where the construction is particularly complex, elevations of

the walls should be shown. This would include conditions where substantial tiedowns, or metal straps providing continuity around openings in wood walls are used to resist lateral loads; and the reinforcing around openings in concrete walls.

(1) Complete Details of All Structural Connections. With the exception of simple connections, such as the typical end nailing of studs to top and bottom plates which can be covered by notes, all connections should be detailed. The orientation and extent of each member at a joint should be shown clearly. The detail should show which members are supported by connecting devices and which are supported by bearing on other members. The connecting devices should be identified, and dimensions shown locating them with respect to the ends and sides of the members connected, and the spacing to other connectors in the joints. This requirement includes nailed connections where splitting of the lumber may occur.

MECHANICAL SUBMISSION

Submission requirements for mechanical items contained in manufactured buildings or building components are given in Part V, Section (B)(5), (a) through (h) of the Rules and Regulations. This document discusses these requirements as an aid to the manufacturer in the preparation of appropriate submission. Subsections (i) and (j), relating to sprinkler and elevator systems are not discussed since these requirements do not normally apply to one and two family dwellings.

(a) Location - Equipment[1] and Appliances.[2] Drawings should show and dimension location, size, and clearances for all equipment and appliances, e.g., fans, warm air furnaces, boilers, absorption units, refrigerant compressors and condensers.

(b) Heat loss calculations, where appropriate. Many trade and professional associations and individual equipment manufacturers have developed heat loss and heat gain calculation forms. The manufacturer should submit his calculations in one of these formats. Examples of such formats have been published by the National Environmental Systems Contractors Association and the National Warm Air Heating and Air Conditioning Association.

(c) Schedules of equipment and appliances. Schedules of equipment and appliances should be shown on the drawings to check whether the equipment used is listed by an approved testing agency and adequately sized to perform in accordance with the code and standard. Therefore schedules should show whether equipment and appliances are listed or labeled by approved agencies and also indicate manufacturer's name, make, model number, BTU/hr, and input rating. Other drawing details to aid proper evaluation are: details of motors, fans, controls, filters, safety devices, connectors, valves, automatic shut-off devices, and pressure relief devices.

Since the type of equipment used in a machinery room determines the fire resistance requirements of the enclosure, it is important that the machinery room drawings be adequately detailed with the equipment properly located and identified.

(d) Duct and register details. Drawings should show location of all ducts, air inlets and outlets, and air dampers and registers. Special attention should be given to ducts located in attics and crawl spaces in order to satisfy fire protection requirements where applicable. Details of material, support, length, size, pitch and insulation of ducts should be provided. Where the systems approach is used when

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[1] In this context, "equipment" is a general term including materials, fittings, devices, appliances, and apparatus used as part of or in connection with the installations regulated by the mechanical code.

[2] In this context, "appliance" is a device which utilizes fuel or other forms of energy to produce light, heat, power, refrigeration or air conditioning.

submitting plans for approval (Vol. I, p. 16), the above details, including openings and ducts for combustion air, for each system submitted for approval should be indicated. Where the ducts, air inlets and outlets penetrate fire barriers, drawings should show necessary details.

(e) Clearances from combustible material or surfaces. Drawings should show clearances from combustible material or surfaces for heat producing appliances (furnaces, boilers, etc.), and all ducts, flues, and chimneys. Isometric views of heat producing appliances showing all clearances (side, back, front, top) are helpful to the plan evaluator and in-plant or field inspector.

(f) Combustion air details. Methods of providing required combustion air should be described. Sufficient make-up air should be provided to take care of combustion devices and exhaust fans in the buildings. Drawings should show location and area of all ventilation and combustion air openings and ducts. Flow directions should be indicated.

(g) Flues, vents and chimneys - details. Details of material, size, type and locations should be provided for flues, vents, and chimneys. Such details should show clearances from air intakes and other vents and flues.

(h) Fire safety requirements. Location and construction details of all fire dampers should be clearly indicated on the drawings. A schedule showing fire damper locations in various rooms, corridors, etc., on each floor facilitates plan review. Also complete drawings of fire sprinkler systems, standpipe system or fire alarm system should be submitted, if required.

PLUMBING SUBMISSION

Submission requirements for plumbing items contained in manufactured buildings or building components are given in Part V, Section (B)(6), (a) through (f) of the Rules and Regulations. This document discusses these requirements as an aid to the manufacturer in the preparation of an appropriate submission.

(a) Layout requirements. A plan or schematic drawing of the plumbing layout, including but not limited to, size of piping, fitting, traps and vents, cleanouts and valves, gas, water, and drainage system, should be provided.

Drawings should include a riser diagram for each plumbing stack. Such diagrams should show pipe, vent, and trap sizes, cleanout fixtures, interceptors and floor drains. Connection and installation details between pipes, fixtures, and appliances should be provided. Drawings should also show proper slope of waste and vent lines and how such lines penetrate walls and floors without destroying structural and fire integrity of such members.

(b) Materials, equipment, and appliances. All plumbing materials should be shown either on drawings, on schedules or in the specifications. All fixtures should be located on appropriate drawings. Fixture unit capacity of system(s) and the make, model and rating/capacity of equipment and appliances should also be indicated. In addition, indicate whether equipment and appliances are listed or labeled. In general, listing, labeling, and location of equipment and appliances is covered under mechanical and electrical submissions. However, rating and capacity of some appliances and equipment is covered by the plumbing code, e.g., sizing of gas piping for gas burning appliances.

(c) Safety controls. Details, make, and model of safety controls (such as for water heaters), their location, and any listings or labelings should be shown. Most mechanical codes include requirements for hot water heaters. However, in some instances these requirements are included in the plumbing code rather than the mechanical code.

(d) Pipe supports. Drawings should provide details of pipe and fixture supports (i.e., type and spacing). Where applicable pipe protection such as wrapping or sealing should be indicated.

(e) Details of vents above roofs. Details of location of vents above roofs and required clearances, including but not limited to clearances from air intakes, other vents and flues, should be provided.

(f) Methods of testing. Information on test methods and results, if required, should be furnished to the Evaluation Agency. These tests may include the following: (1) Water system test; (2) Drainage and vent-system test, (a) water test, and (b) air test; (3) Fixture test; (4) Shower stall test.

ELECTRICAL SUBMISSION

Submission requirements for electrical items contained in manufactured buildings or building components are given in Part V, Section (B)(7), (a) through (i) of the Rules and Regulations. This document discusses these requirements as an aid to the manufacturer in the preparation of an appropriate submission.

(a) Service equipment details. A plan of service equipment, including service entrance, conductors, service raceway and clearances above ground and above structures should be provided. Also details of wall penetration and service entrance cable protection should be shown.

(b) Grounding of service equipment. Methods and details for grounding service equipment, raceways, or cables should be shown.

(c) Single line diagram - Electrical Installation. Single line diagrams should be shown for the entire electrical distribution system, telephone system, T.V. antenna system and fire alarm system. Details of electrical distribution switchboard and individual panels should be provided. Each circuit should be identified.

(d) Load calculations. Calculations for branch circuit and service loads, including methods and assumptions used should be submitted. Basis for calculating branch circuit and feeder loads are given in NEC Article 220 and typical example calculations are given in NEC, Chapter 9. Page 3 of this document gives a suggested form for calculating the service load.

(e) Sizes of all feeders and branch circuits. Drawings should identify and indicate sizes and materials for each feeder and branch circuit.

(f) Details for main disconnect and overcurrent protective devices. Sizes, ratings and locations of main disconnect and overcurrent protective devices should be indicated on drawings.

(g) Interconnection details. The method and location of interconnection between prefabricated components or buildings should be shown. All materials and devices should be located, identified, and listings or labelings given.

(h) Outlets and junction boxes. Installation details and location of all outlet, switch and junction boxes and fittings should be provided on drawings.

(i) Installation of fixtures. Drawings should show methods of mounting and wiring of all fixtures.

In addition to the submission requirements (a) through (i) identified in the Rules and Regulations, the following information should also be provided:

Location of Equipment and Appliances.[3] The location of all equipment and of all fixed[4] and stationary[5] appliances should be shown and located on the drawings.

Listings. Any listing and labeling of wiring, fixtures, equipment and appliances should be provided, giving name of agency and code or standard used as basis for listing.

Name plate rating of all appliances and equipment. Name plate rating of all electrical appliances to be used should be provided giving the identifying name and the rating in volts and amperes, or in volts and watts. When the appliance is to be used on a specific frequency it shall be so marked. Where motor overload protection external to the appliance is required, the appliance shall be so marked.

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[3]Electrical codes define "appliance" as utilization equipment, generally other than industrial, normally built in standard sizes or types, which is installed or connected as a unit to perform one or more functions such as clothes washing, air conditioning, food mixing, deep frying, etc.

[4]"Fixed appliance" is defined in the electrical codes as an appliance which is fastened or otherwise secured at a specific location.

[5]"Stationary appliance" is defined in the electrical codes as an appliance which is not easily moved from one place to another in normal use.

CALCULATION SHEET FOR SERVICE LOADS

ASSEMBLY RATING: _____

Mfr. _____ Model _____ Size _____

General Light Load (_____ 15 amp circuits):

L x W = _____ ft.^{2} x 3 watts/ft.^{2} = _____ watts

Small appliance load (_____ 20 amp circuits):

_____ Circuits x 1500 Watts = _____ watts

(1) Total = _____ watts

First 3000 @ 100% . . . . . = _____ watts

3001-120,000 Watts @ 35% . . . . . = _____ watts

Remainder _____ Watts @ 25% . . . . . = _____ watts

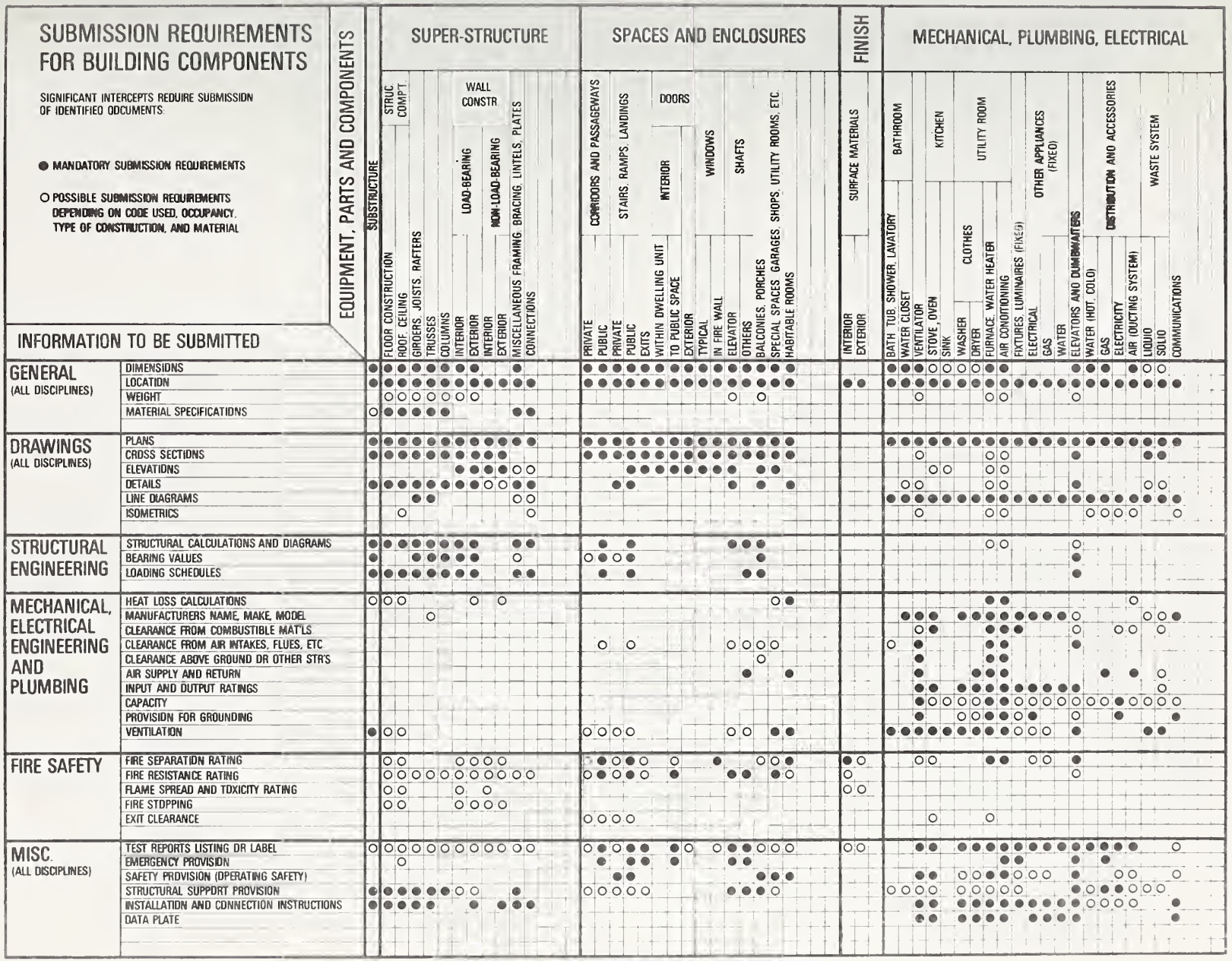
(2) Total = _____ watts

Total Watts (2) _____ ÷ 230 Volts . . . . . = _____ Amps/

		DISTRIBUTION PANEL	
		LEG A	LEG B
General Lighting & small appliances	_____ Amps	_____	_____
Nameplate amperes for motor & heater loads			
Air Conditioner Motor	_____ Amps	_____	_____
Furnace Blower Motor	_____ Amps	_____	_____
Exhaust Fan	_____ Amps	_____	_____
_____	_____ Amps	_____	_____
_____	_____ Amps	_____	_____
Add 25% of amperes of largest mtr.	_____ Amps	_____	_____
Total Nameplate Amperes*			
Disposal	_____ Amps	_____	_____
Dishwasher	_____ Amps	_____	_____
Water Heater	_____ Amps	_____	_____
Clothes Dryer	_____ Amps	_____	_____
Wall mounted over	_____ Amps	_____	_____
Cooking Unit	_____ Amps	_____	_____
_____	_____ Amps	_____	_____
*Where no. of these appliances, exceeds three, use 75% of total	_____ Amps	_____	_____
Furnace	_____ Amps	_____	_____
_____	_____ Amps	_____	_____
Free Standing Range	_____ Amps	_____	_____
	TOTAL		

Panel Rating . . . . . _____ Amps

Main Disconnect Rating . . . . . _____ Amps 2-pole



SUBMISSION REQUIREMENTS FOR COMPONENTS

SUBMISSION REQUIREMENTS FOR COMPLIANCE ASSURANCE PROGRAMS

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General Requirements

Certain requirements and administrative information are basic to the preparation and submission of the compliance assurance manual. This additional information is defined as follows and should be reflected in submitted compliance assurance manuals. (Note: The Administrative Agency should specify the number of copies of the compliance assurance manual to be submitted.)

(1) Name and address of Inspection Agency should be indicated. Also, if not submitted separately, detailed qualifications of the Inspection Agency should be presented.

(2) Approval of compliance assurance manual by the Inspection Agency with date of approval should be indicated on a cover sheet to the manual.

(3) The compliance assurance manual should be properly indexed to all regulatory requirements and all pages of the manual consecutively numbered.

(4) The individual plant name and manufacturer location to which the manual applies should be indicated.

(5) The manual should contain copies of all inspection forms, records, checklists, labels, tags, stamps, insignia, etc., for both the manufacturer and Inspection Agency along with their intended usage for compliance assurance program activities.

(6) The manual should also contain a brief statement in the form of an introduction to the manual to describe the type of manufactured buildings or components to be produced, inspected and certified along with the purpose for the compliance assurance manual in the overall control of construction leading to production unit certification.

(7) The compliance assurance manual should contain either a copy of the contract between the manufacturer and the Inspection Agency or an official signed statement by a responsible officer of the manufacturer that such an agreement is in force and effect.

In addition to the above, organization of the compliance assurance manual should provide for the following:

(1) A space of 3 inch by 4 inch should be provided on the cover sheet of the compliance assurance manual for affixing the Approval Stamp of the Evaluation Agency. A margin of 1 inch should be provided on each following page for affixing the Alternate Approval Stamp.

(2) Compliance assurance manuals should be in such a form that individual pages may be readily removed or replaced.

Revision of Compliance Assurance Manual

Citation. Part V, Section 2(A)(1), "A procedure for periodic revision of the manual".

Administrative Interpretation. It is essential that all approved changes and the resultant additions or deletions to inspection procedures and inspection checklists affecting construction control be made available to the appropriate inspection personnel (i.e., manufacturer or Inspection Agency) and that all such changes be documented as revisions to the compliance assurance manual.

The compliance assurance manual should contain a formalized procedure covering the following points:

(1) All changes to the compliance assurance manual should be submitted to the Administrative Agency within ten (10) days of the change.

(2) Changes in the manufacturer's portion of the compliance assurance manual should be accompanied by any required changes in the Inspection Agency's portion of the manual.

(3) The compliance assurance manual should be formally reviewed at least every three (3) months by the manufacturer and the Inspection Agency and be updated as required.

Comment. The compliance manual should be updated periodically as changes and additions to the manufacturer's and Inspection Agency's programs occur and modifications to the approved building system are made. Any revisions to the manufacturer compliance control program should be coordinated with the Inspection Agency and include their concurrence. Also, any changes in name, address, ownership or location per Part IV, Section 7(A) and (B) of the Rules and Regulations may affect an approved compliance assurance manual and thus require its revision and resubmission. Either CES Documents No. S-01 or S-10 should be used when making application for modifications to an approved compliance assurance program.

Organizational Structure

Citation. Part V, Section 2(A)(2), "An organizational structure for implementing and maintaining the compliance assurance program and its functional relationship to other elements of the organization structure of the manufacturer, which structure shall provide for independence from the production department".

Administrative Interpretation. The manufacturer and the Inspection Agency should each maintain an authoritative and effective organizational element as the focal point for the compliance assurance program.

To be totally effective, the manufacturer's compliance control activity should be an independent activity, such that the plant officer responsible for implementing and maintaining construction compliance is free of any functional obligations with respect to production management that could potentially compromise compliance.

The compliance assurance manual should provide the following:

(1) A chart depicting the manufacturer's organizational setting and functional relationships for compliance control and production responsibilities should be included. The chart should indicate where and by whom coordination with the Inspection Agency should be carried out.

(2) A current functional statement in the form of a directive signed by the plant manager should be included which defines the functional obligation, responsibility and authority of the manufacturer's compliance control activity or, as appropriate, those of the Inspection Agency.

Comment. Of utmost consequence to the overall effectiveness of the compliance assurance program is the organizational freedom and authority to:

(1) Continuously detect actual or potential deviations, marginal code compliance workmanship and trends or conditions which could result in noncompliances;

(2) Objectively assess, document and report findings during all phases of construction;

(3) Obtain any required corrective actions to preclude recurrence of noncompliances;

(4) If necessary, refuse to attach labels to noncompliant units of production until such units have been brought into compliance.

Training and Qualifications

Citation. Part V, Section 2(A)(2)(a), "Company officers and employees in charge of the compliance assurance program must be identified, and their training and qualifications specified".

Administrative Interpretation. Regardless of plant size, adequately trained and qualified personnel to implement and maintain compliance are necessary.

In response to this requirement, the compliance assurance manual should provide the following:

(1) Identification of the individual responsible for directing the manufacturer's compliance control program along with that person's background qualifications and training. If not the same person, the manufacturer should also identify the individual who will be responsible for the receipt, control and attachment of labels when not directly controlled by the Inspection Agency.

(2) Job descriptions prescribing minimum qualifications and training requirements for individuals responsible for compliance control or who make accept/reject determinations with respect to code compliance of the construction.

(3) For each job description above, a brief background summary in the form of a resume' should be provided outlining the educational background, experience, job training, licenses held and any other qualifications of individual personnel assigned to maintain compliance.

(4) The extent of any training activities to be provided in collaboration with the Inspection Agency should be indicated.

Comment. Training and qualification requirements for compliance personnel should give consideration to the following technical factors:

(1) Ability to read and understand drawings, specifications and inspection checklists defining the dimensions and assemblage of manufactured buildings or components and the physical properties required thereof.

(2) Familiarity with the appropriate acceptance tolerances, standards and codes and the ability and skill levels required to objectively inspect buildings or components for code compliance, dimensional accuracy, and intended function.

(3) Capability to understand and use appropriate inspection and production test equipment.

Uniform System of Audits

Citation. Part V, Section 2(A)(3), "A uniform system of audit (in-depth analysis of program effectiveness and means to identify deficiencies) to monitor program performance periodically".

Administrative Interpretation. The Inspection Agency and the manufacturer should audit the adequacy of the compliance assurance program on a periodic basis of at least once a month. A summary report of such audits along with any corrective actions taken by the manufacturer should be prepared by the Inspection Agency on at least a quarterly basis and submitted to the Administrative Agency.

Audits should include, in addition to assessing construction compliance, an examination of compliance assurance procedures, inspection checklists, process controls and inspection records as well as implementing corrective actions to correct all identified noncompliances.

The compliance assurance manual should provide the manufacturer's and/or Inspection Agency's checklists for conducting audits and the procedures for reporting audit findings and corrective actions to the Administrative Agency.

Comment. An example of an audit examination of a production operation would include:

(1) An inspection of production units from that station for construction compliance;

(2) An examination of the adequacy of required documentation (e.g., inspection checklists, code compliance workmanship standards, etc.);

(3) A determination of the familiarity of operator and supervisory personnel with compliance to required documentation;

(4) A review of any prior corrective actions taken;

(5) An evaluation of the adequacy of applicable accept/reject criteria.

Compliance Records

Citation. Part V, Section 2(A)(4), "Complete and reliable records of manufacturing and site operations, if any (suitable means of storage, preservation and accessability of copies of forms to be utilized shall be included)."

Administrative Interpretation. Records are considered one of the principal forms of objective evidence of compliance and as such the manufacturer and the Inspection Agency should assure that records are complete and reliable. Compliance records, test reports and laboratory analyses should be available for review by the Administrative Agency and copies of individual records should be furnished upon request.

The manufacturer and the Inspection Agency should maintain their respective compliance records on file and specify in the compliance assurance manual where such records (or logbooks) will be available for inspection for a minimum period of time as may be required by the Administrative Agency.

The compliance assurance manual should also provide the basis upon which the manufacturer and the Inspection Agency systematically analyze and use records as a means for management action and should include the procedure for assuring the availability, currency, completeness and accuracy of compliance records.

Comment. Individual compliance records should provide evidence that required inspections and production tests have been performed, including component or subsystem identification, unit serial number, inspection or production test involved, inspection characteristics, number of compliant items, number of noncompliant items, nature of code noncompliances, basic causes for rejection and date of inspection. When inspections or production tests so require, the actual measurements or observations obtained should be indicated.

Control of Changes

Citation. Part V, Section 2(A)(5), "A system to control changes in production or inspection procedures".

Administrative Interpretation. The manufacturer and the Inspection Agency should ensure that manufactured buildings or components are fabricated, inspected and production tested to the latest approved building system drawings and specifications. Necessary changes should be approved and so evidenced on applicable production documents and inspection checklists.

The compliance assurance manual should provide a procedure by which the manufacturer and the Inspection Agency can formally control all documents affecting construction compliance and for the incorporation of approved changes to such documents.

Comment. Applicable compliance documentation may include:

(1) The approved building system;

(2) Applicable fabrication or shop-level drawings (e.g., working drawings);

(3) Inspection checklists.

Revised documentation should indicate by special notation all items approved for change together with the effective date of change and reference to the source approval document that initiated the change.

The manufacturer should assure that all documents affecting construction compliance are distributed to the proper personnel at the proper times in order to assure that all inspection functions, including Inspection Agency activities, are accomplished in accordance with the latest approved documents. The manufacturer's system should also provide for the prompt removal of all obsolete drawings and changed requirements from points of issue and use.

Control of Working Drawings

Citation. Part V, Section 2(A)(6), "A system to assure that working drawings and specifications, working instructions and standards, procurement documents, etc., conform to the approved building system".

Administrative Interpretation. Subsequent to the approval of the building system documents by the Administrative Agency as substantiating the adequacy of the manufactured building units to be constructed, it is common practice for some manufacturers to prepare fabrication or shop drawings. The purpose of these drawings is to make maximum use of the materials and effort used to construct the units by delineating detailed layout schemes to be followed by production operators. Such drawings and any subsequent changes thereto should be formally reviewed for compliance with the approved building system. The reviews should be performed by a person other than the one preparing the shop drawing.

The procedure by which working drawings, working instructions and standards and other implementing documents are reviewed for compliance and formally controlled should be defined in the compliance assurance manual.

Comment. It is recommended that inspectors (manufacturer or Inspection Agency) not use shop level or working drawings that have not been approved by the Administrative Agency in conjunction with the system being inspected. To maintain independence from any influence of the manufacturer's organization, Inspection Agency compliance inspections and audits should be made on the basis of the information contained in the approved building system.

Serial Numbering System

Citation. Part V, Section 2(A)(7), "A serial numbering system for buildings or building components".

Administrative Interpretation. Each unit of production to be certified should be assigned an individual serial number. This serial number should be permanently attached to the unit in a uniform accessible location at the early stages of construction.

The compliance assurance manual should indicate the manufacturer's system of individually serializing each unit of production to be certified and should identify the point in the production flow at which serial numbers will be applied.

Comment. Any inspection records or production travellers used as part of the manufacturing process and which are unique to individual units of production should bear the serial number of the unit to which it applies. The use of lot or batch numbers may be more practical for control and identification purposes of high production volume components not requiring individual data plates.

Control of Labels

Citation. Part V, Section 2(A)(8), "The method of safekeeping, handling and attaching labels and identification of those employees responsible therefor".

Administrative Interpretation. Labels should be under the direct control of the Inspection Agency and should only be applied to compliant units by the manufacturer's personnel after the manufacturer's production process consistently produces compliant units and the compliance control efforts of the manufacturer are capable of assuring on-going compliance.

The compliance assurance manual should identify the Inspection Agency employees with responsibility for release of labels and, if possession of labels is granted the manufacturer in accordance with Part IV, Section 3(B)(2)(d) of the Model Rules and Regulations, the identification and background qualifications of the manufacturer's representative who will have custody of labels. The manual should also stipulate the specific procedures and controls to be utilized by both the Inspection Agency and the manufacturer for the issuance, handling, possession, safekeeping, procurement and records of attachment, damage or misuse of labels. When possession of labels is granted the manufacturer's personnel in accordance with the Rules and Regulations, the method by which the Inspection Agency replenishes a manufacturer's supply of required labels should be controlled and the methodology outlined in the compliance assurance manual.

Comment. Labels should be serially numbered and individually accounted for by the Inspection Agency to the Administrative Agency. This should be accomplished through a Label Control Record (CES Document No. C-08) which cross-references each label with the serial number of the manufactured building or component to which it is affixed and gives an approximate date of usage.

Final inspection should include a check that labels are affixed to units in a manner that precludes removal and are located as indicated by the approved building system.

Control of Procurement

Citation. Part V, Section 2(B)(1), "Procedures to assure effective control over procurement sources to ensure that materials, supplies and other items used in production and site operations, if any, conform to the approved plans, specifications and quality requirements".

Administrative Interpretation. The manufacturer is responsible for the adequacy and compliance of all purchased or subcontracted construction materials including; as appropriate, raw materials, building components, subsystems, and equipment. The selection of procurement sources and the nature and extent of control to be exercised by the manufacturer is dependent upon the particular type of materials, products or services, the supplier's demonstrated capability to perform, and the objective evidence of compliance made available.

The compliance assurance manual should define the manufacturer's procedure for ensuring the adequacy and control of procured building components, materials, products and services including procedures for selection of qualified sources, incorporation of all applicable design, code compliance workmanship standards and associated compliance requirements in subcontracts and purchase orders.

Comment. To assure an adequate and economical control of procured materials and products, the manufacturer should utilize to the fullest extent, objective evidence of compliance furnished by suppliers and subcontractors (e.g., building components, subsystems, equipment, etc., acceptance labeled by an approved inspection agency; product approvals and listings by UL, ICBO, BOCA, etc.; building and construction industry grade marks for materials; and similar recognized programs that promulgate, regulate or enforce standards).

Receiving Inspection

Citation. Part V, Section 2(B)(2), "Procedures for inspection of materials, supplies and other items at the point of receipt".

Administrative Interpretation. The manufacturer should ensure that subcontracted or purchased building components, materials and products to be incorporated into the regulated aspects of the construction are subjected to compliance inspection upon receipt, as necessary, to verify conformance to applicable purchase orders, drawings and specifications, catalog descriptions, industry standards, etc. Receiving inspection verfication checks may include, as appropriate, examination for damages due to shipment and handling, visual inspections, physical and dimensional checks, and any functional tests needed to assure compliance.

The compliance assurance manual should contain instructions and inspection checklists for conducting receiving inspections. Receiving inspection instructions should specify any sampling inspection techniques, special methods of inspection or test, and the applicable accept/reject criteria for each inspection characteristic.

Comment. Manufacturer receiving inspections should complement and supplement procurement source compliance control, industry standards, recognized product and materials approvals, agency listing and labeling programs, etc., rather than ignore or unnecessarily duplicate such accepted measures of control. Appropriate procured materials and products should bear evidence of such approvals or be accompanied with required data, specimens, test reports, certifications, laboratory analyses, etc.

Protection of Materials

Citation. Part V, Section 2(B)(3), "Method of protection of materials, supplies and other items against deterioration prior to their incorporation in the certified buildings or building component".

Administrative Interpretation. Manufacturer instructions should designate how purchased items and raw materials are to be stored, including the degree of weather protection to be furnished. Included should be directions on the support of the item, the protection from mechanical damage, and any special controls for the temperature, humidity, or exposure to sunlight, where these conditions could adversely affect the performance of the item or material.

The compliance assurance manual should contain any manufacturer instructions or inspection checklists necessary for the protection of materials against deterioration.

Comment. Manufacturer stores, warehouses and other storage facilities for raw materials, components and in-process work should be adequate for the type of certified building or building component being produced. All such materials should be adequately protected from weather, corrosion, deterioration, mechanical damage and other adverse conditions. Materials having definite characteristics of degradation with age and/or exposure should be marked to indicate the useful life and expiration date.

Disposition of Rejected Materials

Citation. Part V, Section 2(B)(4), "Provision for disposal of rejected materials, supplies and other items".

Administrative Interpretation. The manufacturer should establish and maintain an effective and positive system for controlling nonconforming material, including procedures for its identification, segregation, and disposition. Repair or rework of nonconforming material should be in accordance with approved manufacturer procedures. Information should be included regarding the procedures to be followed with respect to materials that have been damaged, such as the necessity to regrade or test materials that have been exposed to excessive moisture.

The compliance assurance manual should include the procedure to be followed regarding the identification and disposition of rejected materials, supplies and other items to be incorporated into the regulated aspects of the construction.

Comment. All nonconforming materials should be positively identified and segregated to prevent unauthorized use, release to production or co-mingling with conforming materials. The manufacturer should maintain a positive system for identifying the inspection status of materials, components, subassemblies, etc.

Corrective Action

Citation. Part V, Section 2 (C)(1), "Procedures for timely remedial and preventive measures to assure product quality".

Administrative Interpretation. The compliance assurance program should detect and promptly correct assignable conditions adverse to construction compliance.

A procedure should be contained in the compliance assurance manual which defines the corrective action program for all major noncompliances, failures, and critical latent defects discovered by the manufacturer, the Inspection Agency or other state and regulatory agency inspections and tests in-plant and during and after site installation.

Comment. Segregating noncompliant construction from acceptable units of production is not enough for an effective compliance assurance program; the cause of the noncompliant condition must be found and corrected. Occasionally the cause of infrequent or non-repetitive noncompliances cannot be determined and the only action possible is to reject and repair or rework the defective items.

Testing and Inspection Equipment

Citation. Part V, Section 2(C)(2), "Provision, maintenance and use of testing and inspection equipment to assure compliance with the approved building system".

Administrative Interpretation. The manufacturer's compliance control program should include and provide maintenance for suitable inspection, measuring, and production test equipment necessary for compliance assurance activities and to determine and ensure compliance to building system requirements and applicable code compliance workmanship standards and tolerances. Appropriate records of equipment calibration or maintenance checks should be maintained current. The due date or other identification attesting the due date of the next required calibration or maintenance check should be displayed on each applicable item of inspection, measuring, and production test equipment or control device.

The compliance assurance manual should identify each item of required testing and inspection equipment and the station or point in the production process each will be used. The procedure by which such equipment should be periodically validated for accuracy should also be included.

Comment. Such measurement devices as pressure gauges, compression and tensile test machines, weighing scales, leak detectors, temperature indicators and control equipment, moisture meters, dial indicators, etc. should be initially calibrated against certified measurement standards, and at established intervals thereafter to assure continued measurement accuracy. The objective is to assure that any necessary inspection and production test equipment or control device is adjusted, replaced or repaired before it becomes inaccurate.

Frequency of Inspection

Citation. Part V, Section 2(C)(3), "Provision for frequency of sampling inspections".

Administrative Interpretation. The frequency of Inspection Agency audit inspections should consider various factors, each of which affects the overall construction compliance of manufactured buildings or building components. Among these influencing factors are: production volume; design complexity of units; the qualifications of the manufacturer's own in-house compliance control organization; and the experience record of the manufacturer.

It is important to note, and for the manufacturer's compliance control personnel to understand, that the audit inspections by the Inspection Agency personnel are to serve only as a verification of the manufacturer's program. Performance and viability of the overall compliance assurance program depends entirely on the conscientious efforts of the manufacturer's personnel.

The frequency of inspection by the Inspection Agency should be no greater than that necessary to assure construction compliance. An approach toward accomplishing an adjustable frequency of inspection based on construction compliance performance of the manufacturer is outlined in the commentary to this requirement. Based on the estimated or average daily (or weekly) rate of manufacturing, the frequency of inspection coverage, including criteria for recommending possible adjustments, to be provided by the Inspection Agency should be outlined in procedure form in the compliance assurance manual.

Comment. Based upon existing inspection practices, a suggested inspection frequency should initially provide at least one inspection by the Inspection Agency of all four of the major subsystems (i.e., structural, mechanical, plumbing and electrical) on each unit produced (100% inspection); with no less than one inspection visit per month to maintain proper record keeping and reports to the Administrative Agency. As the construction compliance performance of the manufacturer improves (e.g., the number and severity of code violations decreases), an adjustment of the sampling rate (i.e., frequency of inspection) should be implemented by the Inspection Agency and the Administrative Agency so notified.

A reduction in the frequency of inspection can be based on one of three concepts: (1) inspecting every construction item on one unit, but not inspecting all units, e.g. inspection of every construction item on one unit out of four constitutes a 25% inspection frequency; (2) inspecting some, but not all construction items on each production unit, e.g. inspection of one quarter of all construction items on each production unit also constitutes a 25% inspection frequency; (3) in practice, a combination of the two above concepts may be more appropriate to a particular fabrication process and plant layout. Regardless of the sampling method and the frequency of inspection required, it is suggested that: (1) not less than one out of ten consecutive units be inspected; and (2) within ten consecutive units each construction feature should be inspected at least once. The purpose of these limitations is to assure an even and reasonable

distribution of the units inspected, so as to prevent the Inspection Agency, for example, from achieving 25% inspection frequency by inspecting 25 consecutive units out of 100 units and leaving the next 75 units uninspected.

A suggested minimum approach to frequency of inspection for manufactured buildings which allows for fluctuations in degree of construction compliance by the manufacturer is offered by the following description of a multilevel sampling inspection process. The process is illustrated by the diagram in figure 1. It should be pointed out that the inspection frequencies suggested herein and by the accompanying diagram are not necessarily applicable to building components. It is likely that construction of building components could be regulated through the use of sampling rates substantially lower than those suggested herein.

Inspections are initiated by 100% agency inspections of a prescribed number of production units (several states require that at least the first ten units be examined). During this period of full time inspection activity, the Inspection Agency should also evaluate the competency of the manufacturer's compliance control organization to produce units in compliance with the approved building system and compliance assurance manual. This evaluation should give consideration to noncompliant conditions detected, satisfactorily corrected to preclude recurrence, and documented through implementation of the manufacturer's own compliance control program and prior to discovery of such conditions by Inspection Agency personnel.

At such time as the manufacturer's process consistently produces compliant units, Inspection Agency full time coverage may be reduced to a periodic (e.g., 50%) inspection surveillance program. Inspection Agency plant visits for such surveillance inspections should be on a random unannounced basis.

When major construction noncompliances are detected solely by the Inspection Agency during audit inspections at the first sampling rate (e.g., 50%), the Agency inspectors should backtrack and inspect all units produced prior to the unit found deficient and subsequent to the last unit previously inspected. Also, according to the sampling process, audit inspections return to the 100% level for the next M units or production as depicted in the flow diagram in figure 1.

If the M units are compliant, then periodic audit inspections may be resumed as before. Audit inspection coverage may even be reduced further to the second level sampling rate (e.g., 25%) when a prescribed number of production units (e.g. ten) are found in compliance at the first sampling rate. The same conditions apply as above for shifting from one sampling rate to a lower sampling rate. When noncompliant production is found by the Inspection Agency, the frequency of inspection has to be increased or could possibly return to full-time inspection coverage.

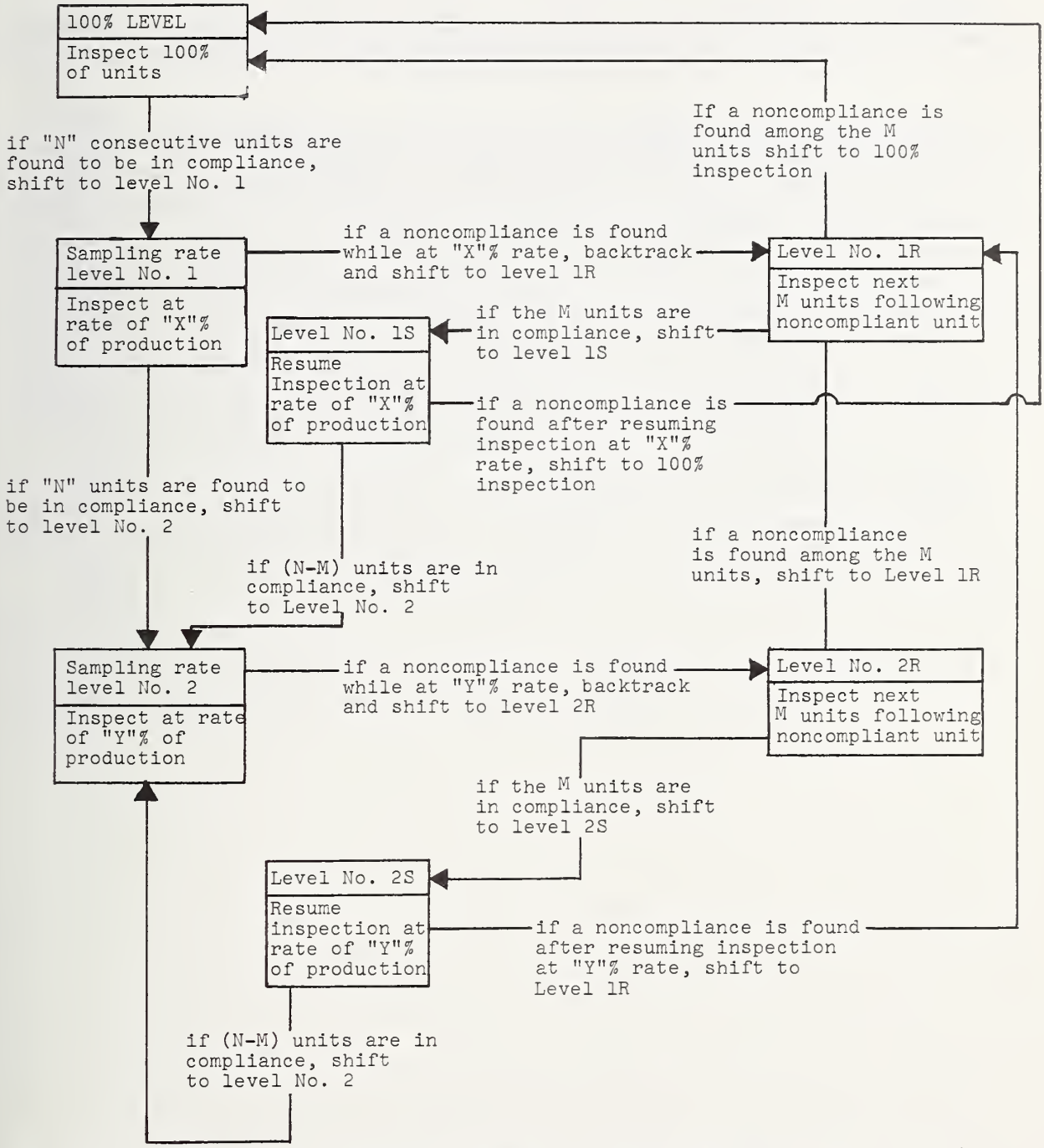
It is recommended that before the Inspection Agency reduces its inspections at any of the above levels notice should be sent to the Administrative Agency of such action.

FIGURE 1

FLOW DIAGRAM

MULTILEVEL SAMPLING INSPECTIONS

BY INSPECTION AGENCY


100% LEVEL
Inspect 100% of units
if "N" consecutive units are found to be in compliance, shift to level No. 1
If a noncompliance is found among the M units shift to 100% inspection
Sampling rate level No. 1
Inspect at rate of "X"% of production
if a noncompliance is found while at "X"% rate, backtrack and shift to level 1R
Level No. 1R
Inspect next M units following noncompliant unit
if the M units are in compliance, shift to level 1S
Level No. 1S
Resume Inspection at rate of "X"% of production
if a noncompliance is found after resuming inspection at "X"% rate, shift to 100% inspection
if "N" units are found to be in compliance, shift to level No. 2
if a noncompliance is found among the M units, shift to Level 1R
if (N-M) units are in compliance, shift to Level No. 2
Sampling rate level No. 2
Inspect at rate of "Y"% of production
if a noncompliance is found while at "Y"% rate, backtrack and shift to level 2R
Level No. 2R
Inspect next M units following noncompliant unit
if the M units are in compliance, shift to level 2S
Level No. 2S
Resume inspection at rate of "Y"% of production
if a noncompliance is found after resuming inspection at "Y"% rate, shift to Level 1R
if (N-M) units are in compliance, shift to level No. 2

KEY "N": Number of production units inspected at 100% frequency (e.g., N = 10)

"M": Number of production units inspected at levels No. 1R and 2R, but less than N (e.g., M = 5)

"X": First sampling rate after leaving 100% inspection (e.g., X = 50%)

"Y": Second sampling rate after leaving "X" sampling rate (e.g., Y = 25%)

Authority for Compliance Assurance

Citation. Part V, Section 2(C)(4), "Provision of necessary authority to reject defective work and carry out compliance assurance functions, notwithstanding any conflict with production department goals and needs".

Administrative Interpretation. The compliance assurance activities of the manufacturer's compliance control organization and the Inspection Agency should not be overridden in any form by plant or site construction schedules or other needs, goals or functions of the manufacturer's production department.

The compliance assurance manual should contain a provision whereby the manufacturer's compliance control activity or the Inspection Agency have the authority to reject noncompliant construction of all regulated aspects of the building system and to refuse to attach labels to such units of production until such time as they have been brought into compliance. This authority should also include the provision for the Inspection Agency to inspect all units produced prior to the unit found deficient and subsequent to the last unit previously inspected by the Inspection Agency.

Comment: Response to the requirement in the compliance assurance manual should also be in accord with the response submitted to that for the "Organizational Structure" (e.g., Part V, Section 2(A)(2) of the Model Rules and Regulations).

Production Flow Diagrams

Citation. Part V, Section 2(C)(5), "A schematic of the manufacturing operation showing the location of inspection stations, and "hold" points for mandatory inspection characteristics".

Administrative Interpretation. Material flow charts, production sequence diagrams and/or plant layout diagrams should be included in the compliance assurance manual. The sequence, type and frequency of manufacturer and Inspection Agency inspection, production test and labeling points, including those for materials receipt and storage, should be specifically indicated on material flow charts or plant layout diagrams showing the production flow of all fabrication and assembly operations. Inspection Agency control points should be identified separately, but should be correlated with the number and descriptive title of the manufacturer's designations. The individual In-Plant Inspection Checklists (CES Document No. C-02) for each station should correspond with the production sequence indicated on flow diagrams.

Mandatory inspection characteristics (i.e., those critical inspection characteristics of the construction which if not in compliance up to a certain point in the production sequence, cannot later be corrected and will thus jeopardize life and safety) and their respective "hold" points should also be individually designated.

Comment. Production flow diagrams should be supplemented by estimated or average daily (or weekly) rate of manufacturing and shipment of units. The Inspection Agency should attest to its capabilities and available resources in support of the compliance assurance inspection and labeling aspects of such schedules. The Inspection Agency should also indicate the degree of inspection coverage to be provided during multiple shift plant operations or other periods of extended plant operations.

Inspection Checklists

Citation. Part V, Section 2(C)(6), "Inspection and test procedures, including accept/reject criteria and mandatory inspection characteristics".

Administrative Interpretation. The In-Plant Inspection Checklists (reference CES Document No. C-02) should be jointly developed by the manufacturer and the Inspection Agency for the particular system to be produced. These checklists, which should serve as the basis for manufacturer compliance control inspections and Inspection Agency monitoring evaluations, should be submitted as part of the compliance assurance manual. Individual inspection and test procedures should bear evidence of Inspection Agency concurrence and should be production station oriented in accordance with the sequence outlined in the Production Flow Diagrams (reference Part V, Section 2(C)(5)) submitted with the compliance assurance manual.

Comment. For production testing, detailed procedures should be prepared describing each step in the testing process, the recording of results, the method of determining compliance including permissable tolerances and the frequency of testing. Procedures should include identification of the test equipment to be used, and, where applicable, the means to be used in determining that it is properly calibrated. The procedures should be of sufficient detail that they can serve as checklists.

Code Compliance Workmanship Standards

Citation. Part V, Section 2(C)(7), "Standards of workmanship".

Administrative Interpretation. The manufacturer in conjunction with the Inspection Agency should provide any necessary code compliance workmanship standards to supplement or complement acceptance standards referenced by codes, drawings, specifications or inspection checklists. Such workmanship standards should compliment accepted codes and industry standards and may be in the form of models, work samples, visual aids, photographs or sketches prepared to assist production and inspection personnel.

The compliance assurance manual should contain any necessary code compliance workmanship standards.

Comment. Code compliance workmanship standards should be developed to describe those inspection characteristics of the construction that are difficult to quantify or describe. When design changes are initiated and approved, affected code compliance workmanship standards should be reviewed and replaced as necessary.

Disposition of Noncompliant Construction

Citation. Part V, Section 2(C)(8), "Provision for disposal of rejects".

Administrative Interpretation. This provision is similar to Part V, Section 2(B)(4) of the Model Rules and Regulations, "Disposition of Rejected Materials", except that this requirement addresses noncompliant construction during the production process.

The procedure in the compliance assurance manual covering the disposition of rejected materials may be expanded to also cover noncompliant construction or, if necessary, a separate procedure for control of construction noncompliances may be included.

Comment. There should be a method of physically identifying construction deficiencies by attaching a piece of flagging or a tag to the item or element in question. This identification should be removed by the person responsible for signing off that element of the construction only when the construction deficiency has been corrected. The inspection form accompanying the unit should contain a notation for all but minor deficiencies that are readily corrected, to provide the means of communicating the effectiveness of the manufacturer's compliance control efforts to the Inspection Agency. Noncompliant units should be identified and their disposition noted in the compliance record as required in Part V, Section 2(A)(4), discussed on page 7 of this document (page 35 of this report volume).

Final Inspection and Certification

Citation. Part V, Section 2(D)(1), "Procedures for final inspection of all manufactured buildings or building components before shipment to the site or storage point, including identification and labeling".

Administrative Interpretation. The compliance assurance manual should provide a procedure for final in-plant inspection (or final production test, if necessary) of all completed manufactured buildings or building components prior to shipment to building sites, staging areas or storage points. In-plant final inspection checklists should provide for verifying that the officially approved certification label and the manufacturer's data plate, as applicable, have been properly affixed in the correct location and that labels, whether applied by the manufacturer or the Inspection Agency, are formally controlled and records maintained on label usage. Labels and data plates should be checked to ensure that they bear correct information and that removal of the label cannot be accomplished without destruction.

Comment. Proper unit identification and final inspection status of completed units should be readily determinable from identification markings and inspection records. Individual unit inspection records should be verified and retained by the manufacturer or Inspection Agency in accordance with the procedure on "Compliance Records", Part V, Section 2(A)(4) in the compliance assurance manual.

Handling and Storage

Citation. Part V, Section 2(D)(2), "Procedures for handling and storing all finished manufactured buildings or building components, both at the manufacturing plant or other storage point and after delivery to the building site".

Administrative Interpretation. The procedures for handling the finished buildings or components should be described in detail, including a description of all equipment to be used, giving capacity and any other pertinent data required to document suitable handling. Handling equipment and fixtures should be capable of performing the specific task for which selected. Equipment should be proof-loaded and test operated prior to actual manufactured building or component lift to verify capabilities.

If certified manufactured buildings or components are to be stored outside any time between leaving the last fabrication station and site installation, proper precautions should be documented to ensure that the finished product can not deteriorate due to the influence of adverse weather conditions, including humidity, heat and cold, wind forces, etc. The environmental protection should permit access of a compliance assurance inspector to periodically examine the interior for water or weather damage or other degradation. The frequency of inspection should depend upon local conditions and should be indicated in the compliance assurance manual.

Comment: Storage plans should give consideration to:

(1) Water ponding or infiltration on roofs, sides or bottom of units;

(2) Excessive humidity levels caused by improper ventilation;

(3) Cracking or racking caused by storing on an un-level surface, by too great a span length between supports, or by over-stacking of units.

(4) Exposure to high wind forces or other unfavorable weather conditions which could damage the building or component.

Packing, Packaging and Shipping

Citation. Part V, Section 2(D)(3), "Procedures for packing, packaging and shipping operations and related inspections".

Administrative Interpretation. After final in-plant inspection, all operations required for cleaning, preservation, packaging, packing, skidding, loading, blocking and bracing aboard the transporter, as appropriate to the type of unit, should be monitored as part of the compliance assurance program. The purpose of these activities is to ensure that deliverable manufactured units are protected against damage or deterioration due to adverse environmental factors or shipping.

The compliance assurance manual should include, as appropriate, those inspection characteristics that identify precautionary measures to protect plumbing, mechanical and electrical subsystems and included appliances and fixtures from damage. In many instances design considerations or minimal protection devices installed into the manufactured building or component's construction during the production cycle can effectively minimize normal shock and vibration damage.

Pre-transport compliance inspections should assure that all internal packaging and parts protection has been properly accomplished and that "ship-loose" items are fully secured.

Comment. If manufactured buildings or components have been in storage between the time of final in-plant inspection and packaging (i.e., three weeks in winter environments; six weeks in other environments), a re-inspection prior to shipping should be performed to verify that the manufactured buildings or components are in fact still in compliance.

Transportation

Citation. Part V, Section 2(D)(4), "Procedures for transportation, including all measures to protect against damage while in transit, and setting forth the modes of transportation to be utilized and the carrying equipment and procedures".

Administrative Interpretation. Procedures should be outlined in the compliance assurance manual to ensure that during the in-transit phase, which occurs between the final station on the plant assembly line and the actual installation of the unit at the site, adequate precautions are taken to protect the compliance integrity of manufactured buildings or building components.

In-transit and/or on-site verification checks should ensure that the manufactured building or component has suffered no damage during hauling and transport. Construction site receiving inspection reports or other documentary evidence to this effect should be available for submission to local enforcement agencies or the Inspection Agency, if necessary.

Comment. The transporter should not impose excessive shock or vibration loads to the manufactured building or component. Appropriate shock and vibration absorption devices should be employed where necessary to dampen such adverse forces to preclude damage to transported units.

Provision for transportation and delivery may be under the cognizance of commercial carriers or other subcontractors, but such arrangements should include conformance with all regulatory requirements as well as protection of the construction compliance integrity of manufactured buildings or components.

Installation Control

Citation. Part V, Section 2(E)(1), "Installation procedures including component placement, equipment and procedures, field erection and finishing work, utility connection instructions and all appropriate on-site inspection criteria and test descriptions".

Administrative Interpretation. Construction compliance for this aspect of the work should be the responsibility of the builder/erector who may or may not be the manufacturer. The compliance assurance program should clearly define the procedures which will indicate compliance of the site installed certified manufactured building or component to the codes and standards which formed the basis of the certification. The procedures should indicate the scope and frequency of installation inspections and should include inspection checklists with applicable criteria and any functional testing techniques indicated. Inspection procedures for installation control should be made available to local enforcement agencies.

Comment. The inspection procedures to be established by the manufacturer should recognize and provide for the susceptibility of the manufactured building or component to incorrect installation resulting in code related deficiencies. The procedures also will depend on the location of the interface between the manufactured building or component and the site installed provisions for its erection. For example, if the foundations are a part of the manufactured and certified unit, soil bearing characteristics directly affect the performance of the unit in service and thus must be included in the inspection provisions. However, the inspection procedures for a manufactured roof component designed and certified to be installed on load bearing walls which are not a part of the certified unit will have to include the load bearing characteristics of the walls, but not the soil bearing characteristics which are necessary to properly support the site erected walls. It should be understood that the omission of any item of installation control in the manufacturer's compliance assurance manual does not relieve the builder/erector from complying with any local requirement for such items.

According to the above discussion, the following list of items may have to be considered in the development of on-site installation procedures and inspections.

(1) Site work

Where specific site work is a precondition for the proper in-service performance of the manufactured building or component, such site work or site related investigations should be detailed in the manufacturer's installation instructions. Examples of such items are:

(a) Soil bearing value
(b) Frost line
(c) Ground water table
(d) Chemical and physical soil characteristics
(e) Surface water drainage
(f) Topography, slope, and other site related considerations

(2) Foundations and Substructure

Where the in-service performance of a manufactured building or component is dependent on specific foundation characteristics, such characteristics and their determination should be detailed in the manufacturer's installation instructions. Examples of such items are:

(a) Accuracy of horizontal and vertical foundation layout.

(b) Size, dimension, and reinforcement of footings, pilings, etc.

(c) Size, dimension, material, and reinforcement of foundation walls, slabs, etc.

(d) Clearances from utility lines.

(e) Location and layout, including dimensional tolerances, for key ways, anchor bolts, sleeves, and other items imbedded in or integral with the foundations.

(f) Provisions for testing concrete and pilings.

(g) Provisions for testing fabricated items such as reinforcing steel, anchor devices, etc.

(3) Utilities and Services

The proper utility connections and devices used in the field installation of manufactured buildings or components can directly affect the performance of any mechanical, plumbing, or electrical subsystems which may be a part of the manufactured unit. Accordingly, such field connections and the devices to be used should be detailed in the building system and should be controlled by proper instructions and installation procedures. Items to be included in such procedures could be:

(a) Water supply; location, size, material, type of connector.

(b) Gas supply; location, size, material, type of connector.

(c) Sewer; location, size, material, type of connector.

(d) Electricity; location and type of connector; rating in volts and amperes.

(e) Air; location, size, material, and type of ducts and duct connectors.

(4) Structural Installation

The structural connections of the manufactured building or component to the site or site work should be adequately detailed in the building system. The installation control procedures should give the information necessary to verify that the structural connections were installed as detailed. The following items may be included in the procedures.

(a) Attachment of anchors and foundation plates to site-built foundations or other work.

(b) Attachment of anchors and foundation plates to the manufactured building or component.

(c) Detail, size, and material of anchors and anchor plates.

(d) Intermodule or component connection; location, size, material and type of connectors.

(e) Roof connectors; location, size, material, and type of connectors.

(5) Fire Protection Provisions

The building system should include details of all field installed fire protection provisions required for the fire related type of construction and other classifications given in the application for approval of the building system and in the building system approval reports (CES Documents No. S-01 and A-03). The installation control procedures should permit the verification that such field provisions have in fact been installed, including such items as:

(a) Fire stopping, both between certified manufactured units and between them and any field construction.

(b) Field applied fire protection of columns, beams, and other structural elements or of partitions and walls to achieve the required fire rating.

(c) Connection of unit to fire alarm systems, sprinklers, and stand pipes, including location, type of connection and connection devices.

(6) Testing

The installation control procedures should include on-site testing procedures for use by those responsible for the installation, inspection, and testing of field installed manufactured buildings or components, including:

(a) Mechanical tests - Furnace operation, including gas supply; flues and combustion air; system balance, including supply and return air volumes; thermostat operation; air conditioning system.

(b) Plumbing tests - Water pressure tests, waste and vent line tests, including hydrostatic or air tests; hot water heater operation.

(c) Electrical tests - Service; main panel, incoming service, branch circuitry, switches, outlets, and installed appliance operation.

Field Repairs

Citation. Part V, Section 2(E)(2), "Organizational provisions for field repair and disposal of rejects".

Administrative Interpretation. The compliance assurance manual should contain specific criteria to define the responsibility and liability of the manufacturer and builder/erector for making the necessary field repairs and rework to bring any deficient on-site installed units into compliance. The procedures for handling field noncompliances affecting the regulatory aspects of the construction should be covered including the reporting to the manufacturer and the Inspection Agency of any noncompliances attributable to improper or inadequate plant inspection.

The compliance assurance manual should also state the procedure to be used for withdrawing labels from units found not in compliance with regulatory requirements in the field. This procedure should also indicate how backtracking of "suspect" units in the field or in the plant which could have a similar noncompliant condition is to be accomplished.

Comment. It is essential that field repairs be consistant with in-plant construction control and that the effectiveness of the compliance assurance program be assessed by a measure of building site noncompliance history. A unit found not in compliance in the field should be investigated and identified either as a single incident peculiar to that unit or as a possible noncompliant condition common to a number of similar units.

Permission for Inspection

Citation. Part V, Section 2(F), "The manufacturer should provide the Administrative Agency with written permission, signed and notarized, for the Administrative Agency to inspect his manufacturing facilities, his products, and building sites under his control at any reasonable time without prior announcement".

Administrative Interpretation. The manufacturer should provide written permission, signed and notarized, for such inspections by the Administrative Agency as part of the compliance assurance manual submittal.

Comment. Any special conditions relevant to granting such permission for inspection should be indicated in writing. These conditions could include any proprietary or restricted plant areas, safeguards to be employed for inspecting hazzardous operations or any limitations or additional permissions required for the inspection of any subcontractor activities.

STATE OF _____

[*Name and Address of Administrative Agency*]

APPLICATION FOR APPROVAL OF MINOR MODIFICATION TO AN APPROVED BUILDING SYSTEM AND/OR COMPLIANCE ASSURANCE PROGRAM

☐ Modification of Building System ☐ Modification of Compliance Assurance Program

Application is hereby submitted for approval of modification(s) detailed below to the building system and/or compliance assurance program. Unless otherwise stated the modifications shall be subject to the same conditions, agreements, limitations and statements contained in the original application for approval and in the building system approval report.

GENERAL INFORMATION

Name of Manufacturer _____

Previous Application No. _____ Previous Approval No. _____

Effectiveness (Label Number(s) or Date(s)) _____

Oral Authorization Obtained ☐ Yes ☐ No Date _____

Documents Submitted (Specify) _____

DESCRIPTION OF PROPOSED MODIFICATIONS(S) _____

Name of Inspection Agency _____

(Name of Applicant)	(Title)	(Signature)	(Date)
(Name of Architect/Engineer (if required)		(Signature)	(Date)

AGENCY USE ONLY Fee Required _____

☐ Modifications Approved ☐ Modifications Disapproved

Remarks _____

Changes to the Building System Approval Report _____

(Name of Evaluator)	(Title)	(Signature)	(Date)
(Name of Agency Official)	(Title)	(Signature)	(Date)

STATE OF _____

[*Name and Address of Administrative Agency*]

APPLICATION FOR APPROVAL OF VARIATION TO A CERTIFIED MANUFACTURED BUILDING OR COMPONENT

Application is hereby submitted for approval of variation(s) to a certified manufactured building or component. Unless otherwise stated the variations shall be subject to the same conditions, agreements, limitations and statements contained in the original application for approval and the building system approval report.

GENERAL INFORMATION

Name of Manufacturer _____

Name of Builder or Owner _____

Previous Application No. _____ Previous Approval No. _____

Label Serial Number(s) _____

Unit Serial Number _____

Location of Unit _____

Documents Submitted (Specify) _____

_____

DESCRIPTION OF PROPOSED VARIATION(S)

_____

_____

_____

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_____

(Name of Applicant)	(Title)	(Signature)	(Date)
Name of Architect/Engineer (if required)		(Signature)	(Date)

AGENCY USE ONLY Fee Required _____

☐ Variation(s) Approved ☐ Variation(s) Disapproved

Remarks _____

_____

_____

_____

_____

(Name of Evaluator)	(Title)	(Signature)	(Date)
(Name of Agency Official)	(Title)	(Signature)	(Date)